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Risk factors of neurosensory deficits in lower third molar surgery: a literature review of prospective studies

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Abstract. This literature review assessed the risk factors linked to inferior dental nerve (IDN) and lingual nerve (LN) deficits following lower wisdom tooth surgery. A computer search of several databases with specified key words was performed. 32 articles were selected; the risk factors for IDN deficit were reported in 4 articles, LN in 9 and both IDN and LN in 19. Data were analysed statistically to evaluate the potential risk factors. Literature review showed specific radiographic signs and intra-operative IDN exposure increased the risk of IDN deficit. Raising the lingual flap significantly increased the risk of LN deficit. Unerupted tooth and lingual split technique increased IDN and LN deficit risks significantly. Age was linked to IDN and LN deficits, and deep impaction was related to IDN deficit, but no statistical tests were performed on these two risk factors owing to the heterogeneity of data from the studies. This literature review found increased age, unerupted tooth, deep impaction, specific radiographic signs, intra-operative IDN exposure and lingual split technique were risk factors for IDN deficit; increased age, unerupted tooth, distal impaction, raising of lingual flap and lingual split technique were risks factors for LN deficit in lower wisdom tooth surgery.

Key words: neurosensory deficit; third molar surgery; literature review.

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Neurosensory deficit is a complication after lower wisdom tooth surgery and its occurrence is not uncommon. The risk of developing inferior dental nerve (IDN) deficit ranges from 0.26 to 8.4% in the literature[8,10,11,13,18,19,22,27,64,65,77,78,83,94,95,97,100,105,110,112], and the risk of lingual nerve (LN) deficit ranges from 0.1 to 22%[8,18,19,52,56,61,64,67,83,94,95,97,100,103,120]. Patients with IDN deficit suffer from paraesthesia, anaesthesia or dysaesthesia of the lip, chin or buccal gingivae of the affected side, whilst those with LN deficit have altered sensation of the tongue with or without taste disturbance. A small portion of the affected population do not recover fully in the long term[17,54]. Researchers have tried to identify the risk factors for neurosensory deficits in lower wisdom tooth surgery to minimize the risk of these morbidities. Many studies have been published but the results vary.

Evidence-based medicine provides better information for patient management. Integrating the best available evidence and the individual patient's circumstances improves the quality of service delivered to the patient[114]. In oral and maxillofacial surgery, evidence-based research is relatively scarce and there are few systematic

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reviews and literature review[60]. This study aimed to identify all available relevant prospective studies in the literature relating to the risk factors for IDN and LN deficits in lower wisdom tooth surgery, to provide a literature review.

Materials and methods

Computer databases, including PubMed, Ovid and the Cochrane Library, were searched from the earliest available date to 8 June 2007. No language restrictions were applied. The electronic search was performed using the keywords: 1, third molar; 2, wisdom tooth; 3, inferior alveolar nerve; 4, inferior dental nerve; 5, lingual nerve; 6, trigeminal nerve; 7, nerve damage; 8, sensory disturbance; 9, sensory deficit; 10, sensory impairment; 11, nerve injury; 12, (1 OR 2) AND (3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11).

The abstracts were reviewed by two independent judges (LYY and LWK). Articles relevant to the study of wisdom tooth surgery and neurosensory deficit were selected. If there was inadequate information in the abstracts or the abstracts were missing, the articles were included in this round. Full articles were obtained for all those included in the first round. Any disagreements between the two judges were solved by consensus. If an agreement could not be reached, a third party (CLK) was consulted.

Further search were performed from the reference list of all the articles included in the first round. Articles relevant to the study of wisdom tooth surgery and neurosensory deficit were selected. Together with the articles obtained in the first round, all articles were evaluated. Two independent judges (LYY and TI) carried out independent evaluation of the articles entered this round, according to the following criteria: articles must be limited to wisdom tooth surgery; articles must specifically list the neurosensory deficit that the subjects experienced; articles must be randomized clinical trials, controlled clinical trials or prospective clinical studies. Articles had to fulfill all these criteria to enter the third round. Any disagreements between the two judges were solved by consensus. A third party (CLK) was consulted if an agreement could not be reached. Articles meeting the listed criteria were entered into the third round for evaluation.

Articles entering the third round were evaluated by two independent judges (LYY and TI) based on the following criteria. First, the articles must contain one or more of the following pieces of information about all the patients who underwent surgery: basic demographic data (mean age or gender of patients); tooth status (status of eruption, depth of impaction or pattern of impaction of the lower third molar); radiographic signs of the lower wisdom tooth root in relation to the IDN; intra-operative data (exposure of IDN, raising of lingual flap, surgical approach or instrument used); and the surgeons' experience. Second, the articles must contain one or more pieces of information about whether the subjects covered by the first criterion suffered from postoperative neurosensory deficit.

Articles had to fulfill both criteria to be included in the final review and literature review. Any disagreements between the two judges were solved by consensus. A third party (CLK) was consulted if an agreement could not be reached.

The data were analysed statistically using GraphPad InStat 3.0, using *t*-tests to compare continuous data and χ^2 tests or Fisher's exact tests to compare categorical data. A 5% level of significance was applied.

Results

367 potential articles were found in Pubmed, an extra 20 articles in Ovid and an additional 11 articles in the Cochrane Library. The abstracts of these articles were screened and 112 articles were considered to be relevant to wisdom tooth surgery and neurosensory deficit, and were channeled into the second round search and evaluation.

12 articles were selected from the reference search of the 112 articles entering the first round. One submitted article from the authors' centre was also included[24]. 125 articles were evaluated by the two independent judges based on the three criteria listed in the second round evaluation. One article was not retrievable. 2 articles were found to be a double submission using the same data set. 77 articles did not fulfill one or more of the three criteria. 80 articles were excluded. 45 articles entered the third round evaluation (Fig. 1).

Of the 45 articles entering the third round of evaluation, 13 articles not fulfilling the criteria listed in this round were excluded. 32 articles were considered suitable for final review. 4 of these reported IDN deficits, 9 reported LN deficits and 19 reported both IDN and LN deficits. 7 of the 32 selected studies were randomized clinical trials and 25 were prospective clinical studies (Table 1).

Age and gender of the patients, eruption status, depth and pattern of impaction of the lower wisdom teeth, specific radiographic signs indicating proximity of tooth root to the IDN, intra-operative exposure of IDN, surgical technique and instrument used, and operators' experience were selected for analysing the risk in IDN deficit. Age and gender of the patients, eruption status, depth and pattern of impaction of the lower wisdom teeth, whether the lingual flap was raised, surgical technique and instrument used, and operators' experience were selected for analysing the risk in LN deficit. The literature review was limited to lower wisdom tooth surgery using the buccal approach (except for the analysis of surgical techniques) to maximize the homogeneity of the data.

Risk factors for IDN deficit

The risk factors for IDN deficit in lower third molar surgery are shown in Table 2.

Basic demographics

The mean age of the 8357 patients in 6 studies[8,13,24,46,117,126] was 27.1 years, of these the mean age of the 211 patients presenting with IDN deficit was 32.3 years. The mean age of the patients with postoperative IDN deficit was greater than that of the patients without IDN deficit. No statistical tests were performed as several studies did not report the standard deviation of the age in their data.

Regarding gender, 3091 females and 4091 males from 7 studies[10,13,16,17,24,65,117] were included. The incidence of IDN deficit in females and males was 1.8% and 1.3%, respectively. No statistical difference was noted between the genders contributing to the risk of IDN deficit ($p = 0.1648$).

Tooth status

2 studies[22,24] with 5621 subjects described the relationship between eruption status and IDN deficit. Incidences of IDN deficit in fully erupted, partially erupted and unerupted lower wisdom teeth were 0.3%, 0.7% and 3.0%, respectively. Excision of unerupted lower wisdom teeth had a higher risk of IDN deficit ($p < 0.0001$).

There were 3 studies describing the relation of depth of impaction and IDN deficit risk[17,24,46]. Different methods of depth measurement were used in these studies. One study categorized the level of the occlusal surface in relation to the adjacent molar[46]. Another study[17] used the Pell and Gregory classification and one[24] used Winter's classification as a measurement method. No literature